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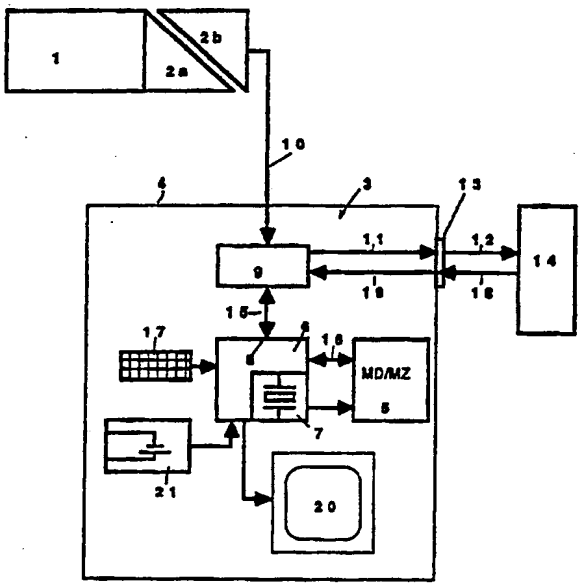
(54) Data acquisition device

(57) The invention relates to a data acquisition device 3 for attachment to a mobile electronic multimeter, in particular a hand-held multimeter 1, a bidirectional data transmission device (interface 2a, 2b) being provided between the data acquisition device 3 and the multimeter and the data acquisition device 3 comprising a memory 5 in which the data (MD) transmitted from the multimeter 1 can be stored temporarily and comprising a sequence control device (6) (processor) which cooperates with a switching device 9 connected downstream of the data transmission device in such a way that the data (MD) are fed either directly to a further interface 13 for a data processing system 14 which can be connected to the data acquisition device 3 (transmission state) or can be stored in the memory (5) together with the time data (MZ) of a time base 7 integrated in the data acquisition device 3 as measured data/measured time data pairs (MD/MZ) (memory state).



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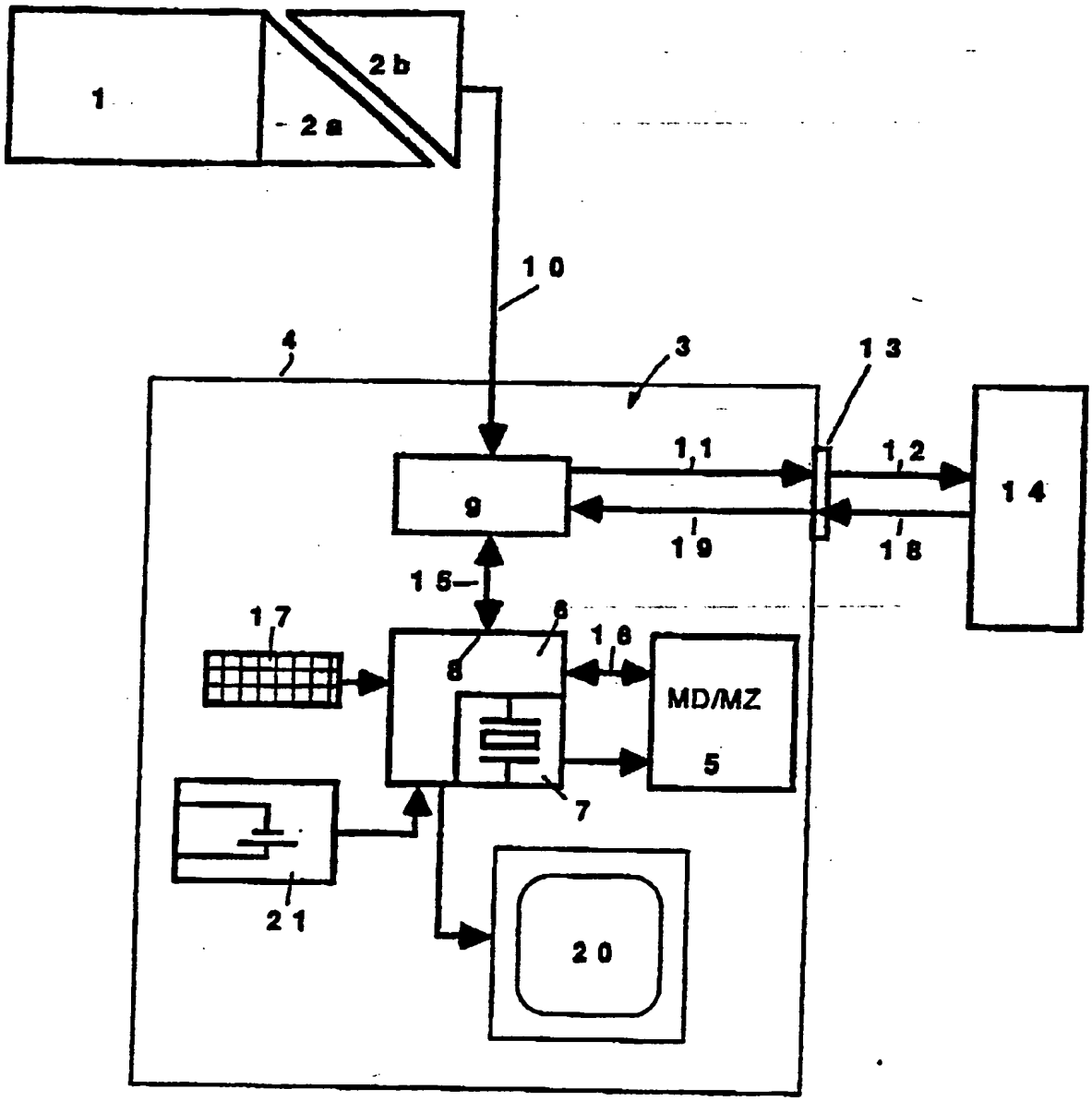
1
2b
2a
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MD/MZ
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Data acquisition device for attachment to a mobile electronic multimeter, in particular a hand-held multimeter

DESCRIPTION

The invention relates to a data acquisition device for attachment to a mobile electronic multimeter, in particular a hand-held multimeter, a bidirectional data transmission device (interface) being provided between the data acquisition device and the multimeter.

Prior art:
The earlier patent application P 42 33 765.8-52 discloses an electrical measuring and test apparatus in which a data transmission device is provided which comprises a processor, a data memory and a programme memory, whereby measured data can be stored temporarily. Measures enabling the stored measured data to be classified chronologically are not provided in the earlier patent application.

The earlier patent application P 42 10 526.9 further discloses a device for transmitting data between a measured value acquisition unit and a measured value processing unit which can be a computer and/or a printer in which the measured value acquisition unit is in the form of a hand-held multimeter or a hand-held test apparatus which relays its measured data via contactless coupling elements to an auxiliary unit which in turn delivers the measured data received to the measured value processing unit.

The auxiliary unit comprises a connection part which is constructed in such a way that a mechanically detachable connection is produced between the auxiliary unit and the measured value acquisition unit and which ensures that the coupling elements correspond to one another at a specified distance for contactless data transmission and the resultant connection apparatus, consisting of the multimeter and the auxiliary unit, can be used as a whole as a portable measuring apparatus. This earlier application is concerned in particular with the type of mechanical coupling and the data transmission device (contactless interface).

The invention is based on the object of constructing a data acquisition device, which can be attached to a mobile electronic multimeter, in such a way that the data stored therein can be evaluated in a versatile manner.

This object is achieved by the combined features of Claim 1. Advantageous further developments result from the subclaims.

The invention advantageously provides for the data acquisition device and the memory, in which the data transmitted from the multimeter are stored temporarily, to comprise a sequence control device which acts on a switching device in such a way that

the data are either further transmitted directly to a further interface for a data processing system which can be connected to the data acquisition device, which can be designated the transmission state, or can be stored in the memory as measured data/measured time data pairs together with time data of a time base integrated in the data acquisition device. The latter operating state is designated the memory state.

The invention thus provides two different operating states. In the transmission state, the measured data are conveyed simultaneously with their acquisition to a connectable data processing system and can there be chronologically classified by combining with time data generated in the data processing system. In contrast, in the memory state, the measured data are combined with time data of the time base integrated in the data acquisition device and the measured data/measured time data pairs are stored in the existing memory of the data acquisition device.

If the stored measured data/measured time data pairs are read out of the memory, it is fundamentally possible for the measured data to be compared with other measured data recorded in parallel owing to their chronological arrangement and/or to record complicated measuring sequences in the case of which different measured variables are recorded by a

plurality of multimeters equipped with data acquisition devices.

The teaching of Claims 2 and 3 concerns a relatively simple type of chronological classification. The time data are derived from the counting pulses of a time base which is started the first time the measured data are read into the memory. The time base runs until the measured data are further transmitted to the data processing system which can recalculate the actual time the measured value was acquired, owing to the measured time data also transmitted, and thus determine a precise chronological classification of the measurement.

This occurs for each individual measured value which is stored in the memory. By means of the invention, therefore, the time base which is present in the processor in any case can be used particularly advantageously a number of times, namely firstly in the conventional manner as a time base for controlling the course of the programme and secondly as a source for deriving measured time data from which the actual clock time data of the acquisition of the respective measuring points can be derived in the computer connected downstream.

By means of an input device according to Claim 4, different commands relating to the control of the

sequence and the parameterisation for data storage can be input into the data acquisition device. This permits particularly mobile operation of the apparatus unit, consisting of the multimeter and the data acquisition device, which operation is dissociated from the computer.

However, it is also possible to influence the sequence control using control data from the data acquisition device, which can be achieved in that the sequence control device can be connected to a control output of the data acquisition device by the switching device.

In accordance with Claim 6, the data present in the data processing system can be retransmitted via a data line and the sequence control device to the display device of the multimeter. A particularly advantageous comparison of measured data which have already been stored and chronologically classified with actual measured data is rendered possible by the features of Claim 7.

In accordance with Claim 8, the data acquisition device is to comprise a separate display on which data stored therein and also data from the data processing system or data from the multimeter can be displayed.

The invention further relates to a process for acquiring the measured data of a hand-held multimeter

which is characterised by the sequence of process steps a) - g).

The invention will be described in further detail with reference to an embodiment shown in the Figure which shows a basic circuit diagram of a data acquisition device attached to a multimeter.

In the Figure, a hand-held multimeter, which comprises an interface 2a, which cooperates with an interface 2b, which is part of a data acquisition device designated 3, is designated 1. Even though the interface 2b of the data acquisition device 3 is shown separately, it should be explained that the partial interfaces 2a and 2b are in each case part of the apparatus associated therewith. The interface 2a is connected integrally to the hand-held multimeter 1 and integrated in its housing. The interface 2b is part of the data acquisition device 3 and integrated in its housing 4.

Within the housing 4 of the data acquisition device 3 is firstly provided a memory 5 in which the measured data MD transmitted from the hand-held multimeter 1 can be stored temporarily. The function sequences necessary for this purpose are controlled by a sequence control device 6 which is in the form of a conventional processor and comprises a time base 7 from which clock pulses can be derived for controlling

the course of the programme. An input/output 8 of the sequence control device 6 is connected to a switching device 9 which is in turn connected by a data line 10 to the interface 2b. The switching device 9 can be adjusted by the sequence control device 6 in such a way that the measured data MD transmitted from the multimeter 1 are fed via the data line 10 and further data lines 11, 12 directly to a data processing system 14 which can be connected to a further interface 13 or, alternatively, are guided via the data lines 15, 16 to the memory and stored there.

The invention further provides that, when the measured data MD are stored in the memory 5, associated time data are stored which are derived from the time base 7 and almost represent the state of a counter which is started the first time measured data are acquired and stored in the memory 5 and runs at least until the measured data/measured time data pairs MD/MZ are transmitted back from the memory 5 via the data lines 11, 12, 15, 16 to the data processing system 14, the switching device 9 being adjusted accordingly. The measured data/measured time data pairs MD/MZ from the memory 5 can be linked there by computer with clock time data MUZ in such a way that the respective clock time of the acquisition of the measured value can be associated with each individual measured value. This is brought about by the fact that the time interval, corresponding to the counter state transmitted

simultaneously as the measured time data record, is subtracted from the actual clock time when the measured data/measured time data pairs are transmitted to the data processing system 14.

The data acquisition device 3 can thus advantageously manage with only one time base 7 and an associated counter. Further measures for the chronological classification of the measured data MD, such as, for example, a separate, independent clock time base and the like, are not necessary.

There is further connected to the sequence control device 6 an input device 17 which, for example, can be in the form of a numerical or alphanumerical keyboard. The input device 17 can be used for inputting sequence control commands for the sequence control device 6 and/or parameterisation commands for storing data in the memory 5.

However, it is also within the scope of the invention to connect the sequence control device 6 via the switching device 9 to a control output of the data processing system 14 such that the data processing system 14 controls and regulates the necessary sequence within the data acquisition device 3.

It is further provided that the data present in the data processing system 14, i.e. measured data MD and

measured time data MZ or measured clock time data MUZ, can be read into the memory via a data line 18, 19 and the data line 15 via the sequence control device 9, and can be transmitted from the memory or directly via the interface to the display device of the multimeter 1 and be displayed there.

The data can either be displayed separately or together with actual measured data, whereby actual measured data can be compared with retained measured data.

Within the scope of the invention it is further provided that the data acquisition device 3 comprises a separate display 20 on which the data of the data acquisition device 3, of the data processing system 14 or of the multimeter 1 can be displayed. Therefore, either measured data MD alone or measured data coupled with time information as measured data/measured time data pairs or data retransmitted from the data processing system 14, in the case of which the measured data are adjacent the clock time at which they were acquired, are displayed.

Reference numeral 21 further designates a separate power supply which is used in particular such that the data acquisition device 3 can be operated without an electrical connection to other apparatus and such that data can be saved in the memory 5 in the switched-off

state.

LIST OF REFERENCE NUMERALS

1	Multimeter
2a	Interface
2b	Interface
3	Data acquisition device
4	Housing
5	Memory
6	Sequence control device
7	Time base
8	Input/output
9	Switching device
10	Data line
11	Data line
12	Data line
13	Further interface
14	Data processing system
15	Data line
16	Data line
17	Input device
18	Data line
19	Data line
20	Display
21	Power supply

CLAIMS

1. Data acquisition device (3) for attachment to a mobile electronic multimeter, in particular a hand-held multimeter (1), a bidirectional data transmission device (interface 2a, 2b) being provided between the data acquisition device (3) and the multimeter, and the data acquisition device (3) comprising:

- a memory (5) in which the measured data (MD) transmitted from the multimeter (1) can be temporarily stored; and
- a sequence control device (6) (processor) which cooperates with a switching device (9) connected downstream of the data transmission device in such a way that the measured data (MD) are either fed directly to a further interface (13) for a data processing system (14) which can be connected to the data acquisition device (3) (transmission state) or can be stored in the memory (5) together with the time data (MZ) of a time base (7) integrated in the data acquisition device (3) as measured data/measured time data pairs (MD/MZ) (memory state).

2. Data acquisition device according to Claim 1, characterised in that the time base (7) (counter) is

started the first time the measured data/measured time data pairs (MD/MZ) are read into the memory (5) and continues to run until the measured data/measured time data pairs (MD/MZ) are transmitted to the data processing system (14).

3. Data acquisition device according to either of the preceding Claims, characterised in that the measured time data (MZ) from the measured data/measured time data pairs can either be connected by computer either within the data acquisition device or within the data processing system (14) to the actual clock time data derived from the latter in such a way that the respective clock time of the measured value acquisition can be associated with individual measured data (MD).

4. Data acquisition device according to any one of the preceding Claims, characterised in that it comprises an input device (17) which is connected to the sequence control device (6) and by means of which sequence control commands and/or parameterisation commands can be input for data storage.

5. Data acquisition device according to any one of the preceding Claims, characterised in that the sequence control device (6) can be connected via the switching device (9) to a control output of the data processing system (14).

6. Data acquisition device according to any one of the preceding Claims, characterised in that the measured data in the data processing system (14) can be read into the memory (5) via a data line (18, 19) and the sequence control device (9) and can be transmitted from there or directly via the interface to the display device of the multimeter (1) and displayed there.

7. Data acquisition device according to Claim 6, characterised in that the data transmitted back from the data processing system (14) can be displayed simultaneously on the display device of the multimeter (1) together with actual measured data (MD).

8. Data acquisition device according to any one of the preceding Claims, characterised in that it comprises a separate display (20) on which data from the data acquisition device (3), the data processing system (14) or the multimeter (1) can be displayed.

9. Data acquisition device according to any one of the preceding Claims, characterized in that it comprises a separate power supply (21).

10. Process for acquiring the measured data of a hand-held multimeter, characterised by the sequence of the following process steps:

a) preparing the measured data (MD) at an interface of the multimeter (1) and transmitting the measured data (MD) to a data acquisition device which can be mechanically coupled to the multimeter and forms a manageable unit therewith;

b) storing the measured data in a memory within the data acquisition device;

c) starting an electronic counting device (timer) within the data processing device synchronously with the storage of the first measured data (MD) in the memory;

d) operating the counting device (timer) during the entire measured data storage process at least until the moment when the measured data are transmitted to a data processing system which can be connected to an interface of the data acquisition device;

e) preparing actual clock time data by means of the data processing system;

f) connecting the clock time data and the measured data/measured time data pairs of the data acquisition device by computer in such a way that the measured data are combined with actual clock time data;

g) storing the measured data and measured clock time data in the memory of the data acquisition device or in a memory of the data processing system.

11. Process according to Claim 10, characterised in that, by subsequent scanning of the data acquisition devices of different mobile electronic multimeters, the measured data of different measured variables for identical measured times can be acquired and correlated with one another.

12. Process according to either of the preceding Claims 10 and 11, characterised in that the measured data (MD) of different measured variables of a plurality of multimeters can be chronologically correlated with one another and displayed on the display device of the data processing system or the data acquisition device.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) -17-	Application number GB 9408754.1
Relevant Technical Fields (i) UK Cl (Ed.M) G1U (UR1512, UR1500, UR2900) H4P (PT, PX) G4A (AKBX, AUXV, AUXX) (ii) Int Cl (Ed.5) G01R	Search Examiner KEN LONG Date of completion of Search 27 JULY 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASE: WPI	Documents considered relevant following a search in respect of Claims :- 1 TO 12

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2096433 A	(MEDTRONIC) see particularly page 2 lines 12 to 23	-
A	US 4616320	(TELEDYNE) see particularly column 1 line 62 to column 2 line 27	-
A	US 4352164	(UTILITY DEVICES) see particularly column 4 lines 61 to 68 and column 7 lines 10 to 21	-

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